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ABSTRACT

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How Shall Creativity Be Measured? Torrance Tests, RAT, Alpha Biographical, and IQ

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Abstract

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How Shall Creativity Be Measured? Torrance Tests, RAT, Alpha Biographical, and IQ

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The construction of a valid, reliable instrument for measuring creative potential is the most pressing and the most challenging problem facing researchers and teachers concerned with human creative behavior. Inevitably, whether trying to study traits of the creative individual or evaluate educational programs for increasing creative potential, the researcher somehow must index "creative" ability. Like the creativity researcher, the teacher also has need for a reasonable and reliable means of assessing the value of creative classroom experiences. The progressive teacher also may wish for more complete information on her students than that provided by traditional IQ's, GPA's and reports of earlier teachers.

Apart from the very real needs of the researcher and the teacher, the problem of measuring creative ability always is interwoven into the core conceptual-theoretical issues in the field. For example: What is "creativity"? Is "creative ability" independent of "general intelligence"? Can we deliberately train creative behavior?

Now it is a truism that creative behavior may take an endless variety of specific forms. We find flexible, innovative thinking not only in the development of Saturn rockets and techniques for heart transplants, and

in all varieties of the creative arts, but in everyday occupational problem solving and decision making, and even in cooking, gift shopping, home decorating and entertaining children on a rainy day. Can there be some measurable dimension of commonality running through all of these grossly different forms of human creative activity?

"Creativity" profitably may be viewed as a flexible, innovative "state of mind" or "life style"--a constellation of attitudes and habits which lead the individual to seek new, imaginative ideas whatever the specific nature of the problematic situation. Indeed, the most repetitive traits of creative individuals are those related to a habitual preference for originality and novelty, a willingness to differ and to take risks, curiosity, adventurousness, and a general flexibility and "openness" to new experience (Barron, 1969; Getzels & Jackson, 1962; Torrance, 1962). We might ask then, what kind of test should, or will, measure the general type of behavior potential described by this creative "life style"?

Three of the best-known tests claiming to measure creative ability, all commercially available, are the Remote Associates Test (RAT; Mednick, 1967a; Mednick & Mednick, 1967), the Torrance Tests of Creative Thinking (Torrance, 1966a) and the Alpha Biographical Inventory (ABI; Institute for Behavioral Research in Creativity, 1963a). Substantively, the three tests are very, very different. Each individual taking the RAT responds to 30 items of a "convergent" variety. For example, given three words (e.g., surprise, birthday, and line), he is asked to find a fourth word (party) which is somehow related to all three stimulus words. According to the theory (Mednick, 1962), the RAT distinguishes between

the uncreative individual with a steep associative hierarchy (composed of just a few strong, common associations) and the innately more creative person who possesses a flat associative hierarchy (constructed of a large number of more equally-available responses).

Each subtest of the verbal forms of the popular Torrance Tests of Creative Thinking requires the individual to divergently list as many different ideas as he can.[1] For example, he is required to ask all the questions he can about a curious picture, list unusual uses for cardboard boxes or tin cans, think of improvements for a stuffed elephant, and predict consequences of an unlikely event.

The Alpha Biographical Inventory, which boasts an extensive validation history with NASA scientists (Taylor & Ellison, 1967; Taylor, Ellison, & Tucker, 1966) and high-school students (Institute for Behavioral Research in Creativity, 1968b), is a 300-item survey tapping the areas of family life and developmental history, academic background, and adult life and interests. Prepared expressly for high school juniors and seniors, the ABI produces both a Creativity and a college Academic Success prediction score.

The purpose of the present study was to compare interrelationships among scores and subscores of the ABI, the RAT, the verbal Torrance Tests, and IQ, using as an experimental population a sample of high school seniors. In keeping with the life-style view of creative thinking described above, some fairly definite relationships were expected. First of all, performance on the convergent RAT, it would seem, depends to a large extent upon a genetically-determined associative ability not totally unlike "general intelligence." Indeed, the Mednicks themselves (Mednick & Andrews, 1967;

Mednick & Mednick, 1967) report meaningful correlations between Ss' scores on the RAT and, for example, performance on the WISC (r= .55), the Miller Analogies Test (r= .41), the ETS Inductive Reasoning Test (r= .43), and the Lorge Thorndike Intelligence Tests (r= .43), concluding that, "The correlations that have been obtained between the RAT and standard measures of intelligence indicate that the high scorer on the RAT also tends to be in the upper IQ range" (Mednick & Mednick, 1967, p. 11). We predicted then, that a student scoring high on the RAT also should score high on the Henmon-Nelson IQ test and on the ABI Academic Success score. On the other hand, the Torrance Tests and the creativity-keyed items of the ABI are totally different in format--one asking for divergent, original ideas in a timed 5- or 10-min. period, the other asking for factual biographical information in essentially an unlimited time period. However, both the Torrance Test scores and the ABI Creativity score should reflect the habitually flexible thinking of the creative individual.

The main overall prediction then, was that an individual's RAT, IQ, and ABI Academic socres would form one interrelated "intelligence cluster," while his scores on the Torrance Tests along with his ABI Creativity score would comprise a mostly independent "creativity cluster."

A study such as this would not be complete without some outside validating criterion of "creativity"--to determine which test measures "real" creative ability. With professional adults, real-life creative abiltiy may be estimated by such criteria as number of scientific articles (or pages, or books) published, number of patents applied for, election to offices in national professional societies, or by a Picasso-like

international recognition of creative accomplishment. Unfortunately, with high school students the indexing of "True" creative ability is more difficult. One not entirely satisfactory criterion, however, was readily available in the present experiment: Five items in the Alpha Biographical inventory ask the student to rate himself on originality and creativity and to report any activities, recognition, or awards in the areas of creative art (drawing, photography, architecture, etc.), writing, and science. Aside from the trustworthiness of S's self reports, one obvious weakness in this "outside" criterion of True creative potential is that the Alpha Creativity score already is based upon these and other ABI items. Naturally, the ABI Creativity score should correlate highly with this criterion of creativity. The only question we could reasonably ask was whether or not the Torrance Test, RAT, or IQ scores also would predict the creativity self-ratings and self-reported creative activities and awards. We expected the Torrance Test scores to better predict the validating criterion score than RAT or IQ scores.

Method

Subjects.--The 51 Ss (22 males and 29 females) were drawn from the total (82-student) senior class of a Wisconsin high school. The 31 seniors who elected not to participate either had a time conflict or expressed a desire not to be tested.[2]

Materials and procedure.--The Remote Associates Test, administered on the first of three days of testing, is composed of 30 items, each of which presents S with three words and asks him to write a fourth word somehow associated with each of the stimulus words. For example, given

poke, go, and molasses, S should respond with slow. As per instructions (Mednick & Mednick, 1967), Ss were allowed 40 min. to complete the test, which appeared to be ample time. In essence, the Ss were under little or no time pressure. The score for each S was simply the number of correct responses as determined by the RAT Scoring Key (Mednick, 1967b).

On the second testing day, Ss responded to four subtests of the Torrance Tests of Creative Thinking, Verbal Form A. Asking (5 min.) required the S to ". . .write out all of the questions you can think of about the picture (an elf-like character looking at his reflection in a pool of water) on the page opposite this one." Product Improvement (10 min.) asked S to ". . . list the cleverest, most interesting and unusual ways you can think of for changing this toy elephant so that children will have more fun playing with it." The Unusual Uses task (10 min.) asked S to ". . . list as many . . . interesting and unusual uses (for cardboard boxes) as you can think of." Finally, the Just Suppose test (5 min.) required Ss to ". . .JUST SUPPOSE clouds had strings attached to them which hang down to earth. What would happen? List your ideas and guesses. . ." The four subtests were scored according to directions (Torrance, 1966b), providing for each test (and for each S) a score for fluency (number of relevant, nonrepeated ideas), flexibility (number of different categories of ideas) and originality (uniqueness of ideas). Also, total fluency, total flexibility, and total originality were obtained by summing across the four subtests. Finally, departing from printed directions, a rough composite of "total creativity" was derived simply by adding the total fluency, flexibility and originality scores for each S.

Because of its 300-item length, the Alpha Biographical Inventory required two class hours, one hour on each of the third and fourth testing days. The Ss worked at their own speed, continuing in the second hour from where they ended in the first. The ABI asks multiple-choice questions in the areas of family life and developmental history, academic background, and adult life and interests. Since each alternative of each item makes a carefully weighted contribution to the total Academic Success (in college) and Creativity prediction scores, the ABI is scorable only by special computer services.

For all three instruments, the standardized instructions specified in the test manual for each test were read aloud to the Ss in the prescribed manner, and Ss seemed to understand all of the tasks. Testing conditions were generally very ideal.

The five items in the Alpha Biographical Inventory used as an "outside" validating criterion of creativity are shown in Table 1, along

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Insert Table 1 about here

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with the points assigned to each of the alternatives. Each S's Validating Criterion Score was the sum of his points for the five items.

For each S then, a Hennon-Nelson IQ score (from school records), a RAT score, 16 scores from the Torrance Tests, an ABI Creativity and an ABI Academic Success score, and a Validating Criterion score were obtained. The data were computer analyzed for the total sample and then for males and females separately, primarily for a Pearson product moment correlation matrix plus descriptive data.

Results

Since the results for males and females differed in some important respects--usually in the direction of larger and "more orderly" correlations for females--data for the two sexes are summarized separately in Tables 2 (males) and 3 (females).

Our first expectation that a student's performance on the Remote

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Insert Tables 2 and 3 about here

Associates Test would relate strongly to his IQ score and to his Alpha Biographical Inventory Academic Success score clearly was confirmed for both males and females. All intercorrelations among Henmon-Nelson IQ, RAT scores, and ABI Academic Success were substantial and statistically significant.

We also predicted that a student's Torrance Test scores would relate to his Alpha Creativity score, but that his "creativity cluster" would be independent of the IQ-RAT-Alpha Academic "intelligence cluster." For males, Figure 2 shows fairly clear results. While IQ, RAT, and Alpha Academic scores were highly interrelated--the rs are even higher than for females--in no instance did performance on any of these three tests correlate noticeably well with Alpha Creativity or with total fluency, total flexibility, total originality or the composite score for the Torrance tests. But contrary to expectations, Torrance Creativity and Alpha Creativity correlated very nearly zero.

For females, the pattern is different. IQ and RAT scores showed some marginal correlations with the Torrance composite and subscores, and Alpha Academic scores related very well to both the Torrance Test

scores and to Alpha Creativity. (For Alpha Academic and the Torrance composite, $r = .53$, $p < .005$; for Alpha Academic and Alpha Creativity, $r = .55$, $p < .005$). Also unlike the male pattern, Alpha Biographical Creativity seemed significantly related to Torrance Creativity, at least when considering the Torrance composite score ($r = .38$, $p < .025$) and the Torrance originality score ($r = .52$, $p < .005$).

The significant interrelationships among fluency, flexibility, and originality scores of the Torrance Tests, and the even higher part-whole correlations between each of these and the Torrance composite score, are quite usual and are of no special importance for present purposes.

The "outside validating criterion" was not highly successful in identifying which test--Henmon-Nelson IQ, RAT, ABI Academic, or the Torrance Tests--predicts "True" creative ability.[3] The Ss' Validating Criterion scores ranged from 0 to 7 (see scoring system in Method section), with a mean of 1.7, a median of 1.0 and a mode of 0. On one hand, we could concede that the measure was crude and insensitive which, in a sense, it was. On the other hand, we reasonably should expect only a handful of these high school Ss to be highly creative, that is, to rate themselves high in "creativity" or "originality" or to actually engage in creative art, writing or science to a substantial degree. But despite this J-shaped distribution of creativity criterion scores, we do find that a female student's Torrance Test scores relate more strongly to the creativity criterion than did her RAT, Alpha Academic or, especially, her IQ (see Table 3). For females only, Torrance fluency, originality, and the Torrance composite score each correlated $r = .34$ or $.35$ ($p < .05$) with the Validating Criterion.

Of the total sample of 51 Ss, nine individuals (four male, five female) scored between "4" and "7" on the Validating Criterion. All nine of these Ss thus had rated themselves above average on originality or creativity, or both, and reported that they were engaged to some significant extent in creative activities (art, writing, or science). The left portion of Figure 4 summarizes mean test scores and standard deviations for all males ($n = 22$), all females ($n = 29$) and for the total experimental sample ($N = 51$). The right portion of Figure 4 summarizes mean scores for the nine Ss scoring highest on the creativity criterion. Again, we see that (apart from ABI Creativity itself) for females the Torrance Test scores seemed to best differentiate the creative stars from the total sample.

Discussion

The first goal of this research was to determine intercorrelations among IQ and three of the best-known, commercially published tests of "creativity." Our expectation of strong relationships among scores on the Remote Associates Test, IQ scores, and Alpha Biographical Academic Success scores was clearly confirmed for both male and female high school students.

Further predictions were that (a) a student's ABI Creativity score should be highly related to his Torrance Test scores, since both should reflect a creative life style, and (b) scores in his RAT-IQ-ABI Academic "intelligence cluster" would not be strongly related to scores in his ABI Creativity-Torrance Test "creativity cluster." As it turned out, sex differences prevented across-the-board confirmation of these two predictions. For males, no test in the intelligence cluster correlated with ABI Creativity or

Torrance Creativity. Further, the correlations between ABI Creativity and Torrance Creativity were exceedingly close to zero.

For female students, most intercorrelations were strikingly higher than for males. Some individual tests from the intelligence cluster correlated significantly with scores in the creativity cluster. Also, ABI Creativity and Torrance Creativity scores tended to be related; for example, ABI Creativity and the Torrance composite score correlated $r = .38$, $p < .025$. Overall, the results for female students present a pattern of positive interrelationships among all tests--especially within the intelligence cluster. The pattern for women, but not men, perhaps is consistent with the oft-cited conclusion of Mackinnon (1971) that at IQ levels below about 120, intelligence and creativity partly covary.

Attempting to unravel the critical problem of "Which test is best?" we took as an "outside" validating criterion five items from the Alpha Biographical Inventory itself. These items seemed, intuitively, to measure what often is meant by "creativity." Two items asked S to rate himself on originality and creativity, three additional items asked S to report his interests and activities in science, writing, or art. For males and females, the strongest predictor of the Validating Criterion score was the ABI Creativity score itself, which is based upon these five and other items in the ABI. For males, no other test score correlated significantly with the Validating Criterion. For females, apart from the ABI Creativity score, only the Torrance Test scores correlated significantly with the Validating Criterion. It is true, however, that had our

sample size been larger, correlations of the ABI Academic and the RAT scores with the Validating Criterion score likely would have reached statistical significance; but again, only for girls.

Regarding our attitude-based "life-style" view of creativity, this hypothesis would have received some inductive support if the Torrance Test scores and the ABI creativity scores had been highly related--since, according to the hypothesis, these totally different tests both should be affected by a flexible, openminded, creative approach to thinking and problem solving. Past research by Davis and his colleagues (Davis, 1971; Davis, Houtman, Warren, and Roweton, 1969), Parnes (1971), and Covington and his group (Covington & Crutchfield, 1965; Olton & Crutchfield, 1969) has shown measurable attitude and personality changes resulting from successful training in brainstorming and other divergent thinking and problem solving procedures. The present data, however, neither support nor refute the life-style view.

If the teacher or researcher wishes to estimate the creative potential of high school juniors or seniors, the Alpha Biographical Inventory probably is the most accurate and valid instrument available, based as it is upon many years' research with creative NASA scientists (Taylor & Ellison, 1967; Taylor, Ellison, & Tucker, 1966) and with high school students (Institute for Behavioral Research in Creativity, 1968b). One important difficulty with the ABI, however, is that it very likely is insensitive to efforts to teach skills of creative thinking--one cannot easily alter what the ABI measures, an individual's personal history.[4] Therefore, if the success of some form of creativity training is to be evaluated, the

teacher or researcher must use instruments which are both valid and sensitive to training effects. Certainly, the Torrance Tests are useable. In addition to the Torrance Tests, the teacher or researcher should consider the use of attitude, interest, or personality tests, such as the Gough (1952) Adjective Check List, the Opinion, Attitude and Interest Survey (1970), the Pennsylvania Assessment of Creative Tendency (Rookey, 1967), or Merrifield's (1970) Thinking Interest Inventory. After all, virtually every effort to "teach creativity" focuses strongly upon changing attitudes and interests in a more creative direction. For high school students, the present research suggests that the Remote Associates Test may be too difficult (average score was 12 correct out of 30 items, with a range of 0 to 23) and too highly related to general intelligence. For students below high school level, the Torrance Tests supplemented by one of the attitude or interest inventories listed above, or perhaps Covington's (1966) Childhood Attitude Inventory for Problem Solving, should provide a helpful and realistic estimation of a student's creative potential.[5]

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Footnotes

1. The complete Torrance battery consists of three figural subtests in each of two forms (A and B), and seven verbal subtests in each of two forms. The present experiment dealt only with four verbal subtests, all from Form A.

2. The authors wish to thank Roland Cross of the Oregon, Wisconsin, School District, and Henry Apple, Roger Wetzel, and the 1970 senior class of the Oregon High School for their excellent cooperation.

3. As noted above, the relationship between ABI Creativity and the creativity criterion score was expected to be high since the ABI Creativity scores are based upon these and other ABI items in the first place.

4. Informal comment by ABI developed Robert Lacklen at the Eighth International Creativity Conference, Buffalo, June, 1970.

5. An extensive list of published and unpublished creativity tests along with attitude, interest, personality, and biographical instruments for assessing creative potential are available in Davis (1971).

Table 1

Creativity Validating Criterion Items

(From the Alpha Biographical Inventory)*

Item	Alternatives	Points
179. How would you describe yourself in originality compared to your classmates?	a. Much more original than most of my classmates.	2
	b. More original than average.	1
267. How do you compare with all other students in your grade in creativity and imagination?	a. I am much above average.	2
	b. I am somewhat above average.	1
287. How good are you in art (drawing, painting, sculpture, ceramics, architecture, photography)?	c. A moderate interest in art. I have done some original work which was exhibited in my school or by a local organization	1
	d. A deep interest in art. I have spent a great deal of time in doing original work and have entered my work in various exhibits and contests.	2
	e. A very deep interest in art. I have spent a great deal of time in doing original work that has been exhibited. I have won one or more awards in competition.	3

20

21

289. How interested are you in science?	c. I have quite a bit of interest in science. I spend a lot of my free time working on extra projects and/or papers. I have entered one or more projects in a Science Fair or similar competition.	1
	d. I have a strong interest in science. I devote much of my time working on projects or papers. My work has been recognized by one or more awards.	2
	e. I have a very strong interest in science. I spend most of my time working on projects or papers. My work has been published or publicly recognized for its contribution to the field.	3
292. How good are you at writing (stories, poems, themes, etc.)?	c. I have a real interest in writing and have had some original work published in my school paper, annual or literary magazine.	1

	d. I have a strong interest in writing. My original work has been published in school or community papers. I have entered my work in state or national competition.	2
	e. I have a very strong interest in writing. My original work has won one or more prizes in competition and has been published in literary journals (other than in my school).	3

* Alternatives receiving "0" credit are omitted.

Table 1

Test Intercorrelations for Male Ss (n = 22)

Test	IQ	RAT	Alpha		Torrance Tests			
			Acad.	Creat.	Flu.	Flex.	Orig.	Comp.
RAT	.76****							
Alpha Ac.	.57****	.70****						
Alpha Cr.	.18	.23	.04					
Torrance:								
Flu.	.04	.08	.18	-.04				
Flex.	.09	.15	.32	-.02	.94****			
Orig.	.26	.16	.21	.06	.77****	.70****		
Comp.	.15	.13	.23	.00	.96****	.91****	.92****	
Val. Crit.	.19	.19	.04	.42**	.17	.13	.24	.2

**$p < .025$

****$p < .005$

Table 2

Test Intercorrelations for Female Ss (n = 29)

Test	IQ	RAT	Alpha		Torrance Tests			
			Acad.	Creat.	Flu.	Flex.	Orig.	Comp.
RAT	.60****							
Alpha Ac.	.54****	.38**						
Alpha Cr.	.29	.28	.55****					
Torrance:								
Flu.	.25	.33*	.36*	.27				
Flex.	.24	-.06	.28	.09	.67****			
Orig.	.45***	.26	.68****	.52****	.68****	.68****		
Comp.	.36*	.26	.53****	.38**	.91****	.82****	.90****	
Val. Crit.	.15	.27	.31	.61****	.35*	.18	.34*	.35*

*p < .05

**p < .025

***p < .01

****p < .005

Table 4

Group Means (and SD's) for All Male and Female Ss

and Means for Male and Female Creative "Stars"

Score	Total Sample			Creative "Stars"		
	Males	Females	Combined	Males	Females	Combined
Hemmon-Nelson IQ	105.14 (12.65)	105.10 (8.96)	105.12 (10.59)	106.00	108.40	107.33
Remote Associates Test	11.46 (5.67)	12.62 (4.14)	12.12 (4.84)	11.00	14.40	12.89
Alpha Academic	199.14 (17.46)	200.83 (19.58)	200.10 (18.54)	199.00	217.80	209.44
Alpha Creativity	202.05 (15.32)	~~192.72~~ 192.72 (20.11)	196.75 (18.62)	215.25	217.20	216.33
Torrance:						
Fluency	48.27 (15.73)	63.14 (14.43)	56.72 (16.61)	55.50	69.60	63.33
Flexibility	27.77 (7.51)	33.21 (6.28)	30.86 (7.29)	31.00	34.20	32.78
Originality	29.54 (16.50)	41.24 (13.48)	36.20 (15.82)	41.25	49.00	45.56
Composite	105.59 (37.03)	137.60 (30.53)	123.78 (36.80)	127.75	152.80	141.67
Validating Criterion	1.95 (2.08)	1.48 (1.84)	1.69 (1.94)	5.50	5.00	5.22